

lightning were noticed, including heat flash, multiple flash, destructive or rushing bolt, as well as the flash from earth upward, all alternating and lasting nearly two hours, when the cloud gradually disappeared. The phenomenon was a beautiful sight.

We must be careful in the matter of describing a flash as proceeding from the earth upward or from the clouds downward. A lightning flash does not last more than a few millionths of a second. In that short interval of time it makes a vivid impression on the retina, and the impression lasts at least one-tenth of a second. If, during that tenth, the eyeball moves even the least bit, it carries this impression with it; an observer may glance up and down several times during that tenth of a second and he will appear to see the lightning flash go up and down between the cloud and the earth. This is purely a subjective phenomenon; it is produced entirely within our own nervous system, and has nothing to do with the lightning, as it takes place after the lightning has entirely passed by.

One may often be alarmed at suddenly noticing that the anemometer has stopped revolving and then starts on again, or that it suddenly begins to turn in the opposite direction and tipped up instead of horizontally. In the presence of a large fly wheel one may glance along with the swiftly moving rim and see it apparently stand still. Such subjects, however, should not be mistaken for anomalies in nature.

#### RAINFALL AT COLON, COLOMBIA.

The following record kept by Mr. O. B. Schaffer, of the Panama Railway, has been kindly communicated by Mr. Robert T. Hill, of the United States Geological Survey. No details are given as to the size or location of the gauge, further than that it was at Colon:

##### *Memorandum of rainfall at Colon, R. C.*

	1893.	1894.	1895.		1893.	1894.	1895.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	1.73	5.35	3.85	August .....	15.10	23.02	14.15
February .....	3.86	1.69	1.89	September .....	9.92	18.79	12.11
March .....	1.81	0.36	2.08	October .....	12.28	12.43	16.47
April .....	8.05	2.18	22.36	November .....	17.78	23.66	.....
May .....	6.65	9.84	16.17	December.....	30.94	25.12	.....
June .....	12.34	12.24	9.25	Totals.....	131.90	153.76	.....
July .....	11.44	19.08	17.10				

#### SENSIBLE TEMPERATURES OR THE CURVE OF COMFORT.

The Editor has been requested to state what methods should be used in order to calculate the sensible temperature when the ordinary wet and dry bulb thermometers have been read. This is a subject upon which, at present, there is no agreement among the authorities and, indeed, he knows of no satisfactory investigation upon the subject that he could recommend others to as a model, although for a hundred years past the subject has frequently been referred to, and it is quite generally conceded that the temperatures shown by a thermometer is a very imperfect index to that sensation of heat experienced by human beings.

Before attempting to express the sensible temperature in degrees, on the Fahrenheit scale, we are forced to realize that no two individuals are likely to agree very closely as to whether a given condition of the atmosphere should be called hot or cold, comfortable or uncomfortable. An extended effort was made in Washington in 1872-5 by Mr. J. W. Osborne to secure a corps of observers who should record several times daily their individual sensations. From these records he anticipated that it would be possible to establish a scale of terms closely corresponding to the scale of thermo-

metric degrees, by means of which all observers would be able to record their sensible temperatures. But different individuals differed so entirely in their sensations on the same day that nothing satisfactory could be made out of a year's records by twenty or thirty observers. It is a matter of every day experience that even one and the same observer is affected differently by the weather under different circumstances, for instance, before and after eating or drinking; when clothed warmly or thinly; before and after a bath; and so on indefinitely. Recently, several complaints have been made in the daily papers to the effect that Weather Bureau predictions of warmer or colder weather were of no use to the workmen in the streets of New York because the Weather Bureau thermometers were high above the ground on tall buildings, and a change of 1° or 2° at those elevations might mean 5° or 10° in the street below. Now, the fact is that an observer, or especially a working man, may suffer from perspiration and, perhaps, sunstroke in the streets, whereas, if he were on top of a high building he would think it delightful tropical weather. The occupation in which a man is engaged is one of the most influential factors in determining his sensations as to temperature.

It must be evident that if we are to attach any definite conception to the idea of sensible temperature, we must ignore all the variations and irregularities introduced by clothing, by sickness, and by occupation or work, that is to say, the one who observes and the critic for whom we make predictions must be in normal health, perfectly quiet and passive, and clothed in the lightest possible manner. But even this is not sufficient. There is almost an infinite variety of normal physiological structures from the fair-skinned Caucasian to the black-haired Malay, and the black-skinned negro, each adapted to some special climate. Our standard of sensible temperatures must be modified to suit each of these different natures.

It is generally supposed that the blacks enjoy hot climates, but the white race cold climates; but so far as my observation goes it is easy to find here the weather so hot that the blacks do not enjoy it, or so cold that the whites do not enjoy it. It is probable that there is only a narrow range of temperature, moisture, and wind that is really perfectly enjoyable to each race. Without specifying any particular formula by which to combine atmospheric pressure, temperature, moisture, and wind into one figure that shall represent the so-called sensible temperature, I would prefer requesting those interested in this subject to simply make a note of the fact whenever they feel like saying "well this weather is just perfect." I have personally made a number of records of this kind in summer and winter. Having noted that my general sensation is that of a delightful atmospheric influence, I have then examined the temperature, pressure, and the wind at the spot where I happened to be in order to ascertain, if possible, which was the important meteorological element in bringing about this pleasant condition. All such results can be charted in a little diagram. On the left hand side is a vertical scale of relative humidities from zero up to a hundred, at the bottom is a horizontal scale of air temperatures from minus ten on the left up to a hundred on the right. At the proper point on this diagram I enter a 5 to indicate the fact that on one occasion I was very comfortable when a 5-mile wind was blowing and the temperature was 80° and the relative humidity 20°. At another time I enter a 5 to indicate that I was also perfectly comfortable in a 5-mile wind with a temperature of 40° and relative humidity of 60°, but a temperature of 20° and a humidity of 80° with a 5-mile wind seemed very raw. I join the first two points on my diagram by a straight line. I might prolong it so that it would pass through the third point, but while the first point of the line represented comfort the latter part of the line

represented discomfort. If now I curve the line to the right as the humidities increase, I find that with a temperature of 60° and a humidity of 80° and a 5-mile wind I am also comfortable. If I prolong the line further, it reaches the point where the temperature is 80° and the humidity nearly 100°, but here I am again uncomfortable, with a feeling of suffocation. In this way I try my way around over the diagram until I have drawn a curve, a sort of parabolic curve, connecting all the temperatures and humidities that produce a feeling of perfect comfort when a 5-mile wind is blowing. A similar curve may be drawn for a 1-mile wind. There is almost no curve for absolute calm. A 20 or 30 mile curve of comfort is confined to that region of the chart where the relative humidity is quite high.

A series of curves like this give one a clearer view of the relation between our sensations and the atmospheric conditions than any other method that I know of. It does not answer the query, how shall I compute the sensible temperature, but it does better than this in that it enables each person to make for himself his own personal diagram of what may be called sensible temperature curves. He may, for instance, draw one curve for extremely raw cold sensations, another for suffocating hot, another for stimulating or irritating dry sensations. A series of curves like these for various parts of our country and for persons of very different temperaments will constitute a most important contribution toward the eventual discovery of a method of computing and predicting the sensations of temperature, which, as is readily seen, is not temperature at all, but a nervous sensation of very complex origin.

#### SENSATIONAL METEORIC STORY.

In a New York paper of September 10 there appeared a remarkable story of a meteoric shower at Mill River, Jamaica, which was said to have occurred on August 30. On calling the attention of Mr. Maxwell Hall to this matter, he, as government meteorologist for Jamaica, replies as follows:

In the Gleaner (a Jamaica newspaper) of the 31st of August there was an account, given by a lady, of a supposed meteoric fall at her house on the 20th of August.

I wrote her September 1, but did not receive a reply until the 13th. The whole thing was a mistake; lightning struck a tree close to her house with an explosive effect; it may have been "ball" lightning. She wrote me that the little stones noticed at first are to be found all through the district; and they seem to me to be very small waterworn pebbles. I have, however, taken steps to have them analyzed.

The account given in the New York paper is shamefully exaggerated.

It would seem that the sensational dispatch from Kingston to the New York paper was intended especially to tickle the palate of the American reader. We are so accustomed to wonders in these days of great human inventions, we hear so much about the multimillionaire syndicates, the latest wonders in electricity, the fastest ships, and the wonderful guns, that the active newspaper correspondents have determined that nature shall not be outdone by man and have undertaken to assist her to perform miracles. They rarely describe any ordinary meteorological phenomenon without exaggerating it to such an extent and incorporating so much of the products of their own vivid imagination that one scarcely recognizes the kernel of truth in the mass of verbiage.

#### INCREASE AND DECREASE OF FRESH WATER LAKES.

The Editor has lately received a letter inquiring what are the recognized years in which lakes attain their maximum and their minimum extent. This query sounded at first as though there might be in some part of our country a recognized periodic increase and decrease of the lakes. Fluctuations of some kind undoubtedly occur everywhere throughout

the world and depend upon the balance between accumulated rainfall and accumulated evaporation. There is no reason for a regular or chronological periodicity. It can hardly be said that periodic fluctuations in rainfall alone would have anything like corresponding fluctuations in the height of water in large lakes, although this might be the case for small ponds. Many years ago the Editor made a calculation based on the best data accessible to him, showing that the annual fluctuation in the level of the water in Yellowstone Lake exactly followed the accumulated sum of the rainfall minus the evaporation. In this calculation he was much impressed with the uniformity of the outflow from this, and in fact from every large lake. A large change in the height of the lake level produces only a small change in the rate of outflow, so that months and even years may be required to counterbalance the influence of a special rainy season. In Europe some attempts have been made to connect fluctuations of lakes with the rainfall, but no periodicity that has been deduced for that part of the world can be said to hold good for America. In this country too many important changes are being made by human agencies to enable us to make any simple connection between the meteorological phenomena and the levels of the smaller lakes. For instance, in California, according to a newspaper paragraph, extracted from The Hanford Sentinel, Lake Tulare, which should have an area of at least three hundred square miles, is now as "dry as a chip." It is true that this statement is made by the Sentinel on the authority of one person, Mr. W. P. McCord, an old farmer of this region, and the Sentinel adds that:

The reclamation of lake lands has been regularly noted in the columns of this paper for years, but this season has witnessed the most extensive spread of the interests of the husbandman. At the mouths of Cross Creek and Tule River reclamation ditches and levees have been thrown up so that the water that may come with a wet season will be taken care of and an immense area of rich soil irrigated.

It is useless to attempt a meteorological or natural explanation of phenomena such as this, which are mainly due to the artificial conditions of civilization.

#### NOT BALL LIGHTNING.

The Pensacola Daily News of August 17 publishes the following paragraph on the authority of Mr. Ross E. Pollock:

Last evening at 8:42 a very luminous object made its appearance in the northeast and moved slowly toward the east, being visible for about two seconds, then disappeared. At the expiration of five seconds a tremendous explosion occurred like that of a big gun.

This interesting item appears as "a meteor." as it properly should, in the regular monthly journal of the Weather Bureau observer at Pensacola, Mr. A. B. Crane; but it is enlarged upon in the Pensacola Daily News by Mr. Pollock, who is a map distributor and not a regular observer, and is spoken of by Mr. Pollock as "probably ball lightning," which it certainly was not. It was an aerolite or small solid substance shooting from the outside interstellar space into the earth's atmosphere and made visible by the heat thus generated. It was seen at places many miles apart, and the lines of sight probably all converged toward a region 50 or 100 miles above the surface of the earth, where this body rapidly pursued its path until it was burned up. The noise, or so-called explosion, of these aerolites appears to be generated in a manner similar to that of the snapping of a whip or the striking together of two hard substances. It may be called an explosive noise, but there is no explosion, properly so called.

On the other hand, ball lightning is always near the ground; the so-called ball seems to roll along the surface of the ground or of some object near the ground, pursuing an irregular course, and eventually bursts with a noise like a pistol. It has never been observed at a greater distance than